Department of Energy
Bonneville Power Administration
PO. Box 3621
Portland, Oregon 97208-3621

NOV 2 6 1990

In reply refer to PJS

Interested Parties:

Subject: Review of the Sturgeon, Resident Fish and Wildlife Projects for 1989/1990

The Bonneville Power Administration (BPA) held a public meeting on November 6-7, 1990, for the purpose of review, coordination, and consultation of the BPA-funded projects for sturgeon, resident fish, and wildlife in the Columbia River Basin (Basin). The comments received after the meeting were favorable and the participants agreed that the meeting was stimulating and productive. The information exchanged should lead to better coordination with other projects throughout the Basin.

The following pages list the projects by title, the project leaders and BPA's project officers, and an abstract of each leaders presentation. Remember: these summaries are in some cases preliminary; they are subject to change and should not be auoted without consulting the project leader.

As promised, this information was assembled and is being disseminated to interested parties to further the goals of the meeting. If you have any questions, please feel free to contact the respective project leader or the BPA project officer at (503) 230-5215.

Sincerely,

Robert Walker
Biological Planning Branch

Sincerely,

Fred W. Holm
Biological Planning Branch

Enclosures

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BONNEVILLE POWER ADMINISTRATION
FISH AND WILDLIFE PROGRAM REVIEW, COORDINATION, AND CONSULTATION

LIFE HISTORY AND POPULATION DYNAMICS OF SUBADULT AND ADULT WHITE STURGEON BETWEEN BONNEVILLE AND MCNARY DAMS. R.C. Beamesderfer - Oregon Department of Fish and Wildlife, Clackamas, OR. (BPA Project Officer: Fred Holm)

Oregon Department of Fish and Wildlife has been conducting research since 1987 to determine if and how construction and operation of dams in the lower Columbia River has contributed to the decline of white sturgeon. Dams block movements, isolating sturgeon populations in a series of reservoirs. Dams also block movements of anadromous prey and create a more lake-like habitat which favors development of an altered community of predators, competitors and prey. We will be comparing potential production of sturgeon populations in the impounded section of river between Bonneville and McNary Dams with potential production in the free-flowing river downstream of Bonneville Dam to estimate dam effects. Potential production reflects all potential dam effects on sturgeon and eliminates potential bias resulting from the effects of fishing on the standing stock. Initial efforts have focused on methods of collecting a large, representative sample of sturgeon and of estimating age and maturity. Current efforts entail estimating reproduction, mortality, growth, and abundance parameters needed to calculate potential production.

REPRODUCTION, EARLY LIFE HISTORY, AND HABITAT REQUIREMENTS OF WHITE STURGEON DOWNSTREAM FROM BONNEVILLE DAM. George T. McCabe, Jr. - National Marine Fisheries Service, Seattle, WA. (BPA Project Officer: Fred Holm)

The National Marine Fisheries Service, in conjunction with the Washington Department of Fisheries, is studying the reproduction, early life history, and habitat requirements of white sturgeon Acipenser transmontanus downstream from Bonneville Dam, the lowermost dam on the Columbia River. The section of the Columbia River downstream from Bonneville Dam is being considered a "control" area, allowing comparisons between data collected downstream from Bonneville Dam and data collected in the impoundments between Bonneville and McNary dams. Downstream from Bonneville Dam, white sturgeon typically spawn from late April through late June or early July at water temperatures ranging from 10 to 18" C. Spawning occurs from the dam to points to least several miles downstream from the dam; spawning occurs in high water velocity areas with a cobble or rock bottom. Stage 2 (freshly fertilized) white sturgeon eggs were collected in areas with mean water column velocities that ranged from 1.2 to 2.8 m/s and depths that ranged from 4.3 to 21.3 m. In 1987 and 1988, white sturgeon larvae were collected more than 30 miles downstream from Bonneville Dam. In 1989, which was a higher flow year than 1987 and 1988, a larva was collected more than 35 miles downstream from Bonneville Dam. Small young-of-:he-year (Y-O-Y) white sturgeon were collected in the upper Columbia River estuary (River Mile 31) in 1989; presumably these Y-O-Y had been transported as larvae to the upper estuary, a freshwater environment, before metamorphosing.

Catches of white sturgeon juveniles in the Columbia River downstream from Bonneville Dam were patchy. Catch data indicated that juvenile white sturgeon tended to be more abundant in water 9.1 m and greater in depth, at least during daylight. Because of the protracted and spawning period and different environmental conditions, there can be large variations in lengths of white sturgeon from a specific year class. These large variations precluded separation of white sturgeon, except for the very young, into year classes using length-frequency histograms. The Y-O-Y catches were relatively low from 1987 to 1989, ranging from 11 in 1988 (less than 1 percent of total catch) to 111 in 1989 (4 percent of total catch). Data from 1989 indicated Y-O-Y growth was relatively good, with the mean fork length increasing from 85 mm in July to 234 in October.

Since the white sturgeon is a demersal species, benthic surveys were conducted in conjunction with juvenile sampling to determine the relationship between white sturgeon densities and the benthos. The relationship between benthic invertebrate densities and white sturgeon densities was poor. The feeding habits of juvenile white sturgeon from two locations in the Columbia River downstream from Bonneville Dam were examined in 1988. Results from the stomach analyses indicated that juvenile white sturgeon fed on benthic organisms, but not necessarily in proportion to the importance of these invertebrates in the benthos. Corophium salmonis, a tube-dwelling amphipod, was overall the most important food item. Other important prey included the clam Corbicula manilensis and eulachon Thaleichthys pacificus eggs in May. Results from the stomach analyses suggested that food may be limited for juveniles, at least in certain areas of the river, in September-October.

LIFE HISTORY AND POPULATION DYNAMICS OF SUBADULT AND ADULT WHITE STURGEON DOWNSTREAM FROM BONNEVILLE DAM. John DeVore - Washington Department of Fisheries, Battleground, WA. (BPA Project Officer: Fred Holm)

The Washington Department of Fisheries (WDF) participates in a dedicated research effort to determine the status, habitat requirements and overall productivity of white sturgeon populations in impounded and unimpounded regions of the Columbia River. As part of a coordinated effort to determine the effect of hydropower development on Columbia River white sturgeon populations funded by the Bonneville Power Administration (BPA), WDF has the responsibility of conducting an intensive creel census in the area between Bonneville and McNary dams to estimate the harvest of marked white sturgeon as well as collect biological data and samples. These products are provided to the Oregon Department of Fish and Wildlife to supplement their research on impounded Columbia River white sturgeon populations. Another WDF contractual obligation in the BPA sturgeon research program is modeling the population dynamics of white sturgeon in the unimpounded lower Columbia River downstream from Bonneville Dam. There are other funding sources that support WDF Columbia River sturgeon research that dovetail into the BPA funded research efforts. Dingell Johnson/Wallop Breaw and state of Washington monies fund sturgeon tagging in the Columbia River downstream from Bonneville, sturgeon egg and larval sampling (products that assist the National Marine Fisheries Service in their BPA research obligations), recreational fishery sampling downstream from Bonneville Dam and commercial fishery sampling downstream from McNary Dam.

Modeling the population dynamics of white sturgeon downstream from Bonneville Dam presents some unique problems that need to be resolved in order to effectively use this information in a controlled comparison with impounded population productivity parameters. Open system assessment requires an understanding of the migrations of Columbia River white sturgeon in marine waters as well as the age structure of that proportion of the Columbia River population residing in marine areas at any one time. Estimation of fecundity and the frequency of spawning by age of adult broodstock is necessary to define the reproductive potential of the population. Estimating the abundance of young white sturgeon (to as early an age class as possible) would provide the best measure of recruitment for population dynamics modeling although recruitment to fisheries continues to be the earliest age classes that recruitment has been quantified, There has been progress towards defining these and other components in our modeling efforts. WDF personnel monitored and sampled adult broodstock during gamete collection efforts by Oregon private aquaculturists downstream from Bonneville Dam. Valuable age and maturity data was obtained and this information will be supplemented by continuing this activity. Abundance, exploitation and mortality estimates for the exploitable portion of the population have been refined and efforts to broaden this scope to younger and older age classes will be attempted. Yield curves (percent unexploited biomass vs. exploitation) that describe population productivity are being developed for both the impounded and unimpounded populations and initial comparisons will be made in the coming year.

REPRODUCTION AND EARLY LIFE HISTORY OF WHITE STURGEON BETWEEN BONNEVILLE AND MCNARY DAMS. Lance Beckman/Mike Parsley - U.S. Fish and Wildlife Service, Cook, WA. (BPA Project Officer: Fred Holm)

The U.S. Fish and Wildlife Service (USFWS) sampled white sturgeon (Acipenser transmontanus) eggs, larvae and juveniles in the three Columbia River pools between Bonneville (RM 146.5) and McNary dams (RM 291.5) from February through November 1989. White sturgeon successfully spawned in all three pools, though there was considerable variation in numbers of eggs and larvae collected. Spawning occurred only in the tailrace areas of higher velocities; eggs were collected in the upper three river miles of each pool at water temperatures from 13 to 19" C. Initiation of spawning in each pool was progressively later upstream, starting 11 May, 24 May, and 06 June in Bonneville, The Dalles and John Day pools, respectively. Larvae were collected further downstream in Bonneville and The Dalles pools during 1989 than in 1988.

Post-larval and young-of-the-year white sturgeon were collected for the first time during the study but only in Bonneville Pool. Young-of-the-year white sturgeon were collected most often at depths ranging from 23 to 49 m and as far as 55 kilometers downstream from The Dalles Dam.

Juvenile white sturgeon were most abundant in Bonneville Pool; catch per effort there was similar to 1988. Catch per area of white sturgeon remained stable in Bonneville Pool during 1989 while catches declined 27% in The Dalles Pool from 1988. The CPE was lowest in John Day Pool, with densities only 10% and 16% of those found in Bonneville and The Dalles Pool, respectively. Based on 1989 catches, recruitment has been low in the three pools above Bonneville Dam since 1986. No age I white sturgeon were collected during 1989, with six and four age II white sturgeon collected in Bonneville and The Dalles Pool, respectively; no white sturgeon younger than age III were collected from John Day Pool. Growth of white sturgeon in the pools above Bonneville Dam was greater than in the lower river through age V. Considerable overlap in size range of each age group through age VII occurred.

Evidence of predation on white sturgeon eggs by largescale sucker, common carp and northern squawfish was observed in the McNary Dam tailrace; however predator collections were small and the level of egg predation was not determined.

White sturgeon consumed a wide variety of prey, mostly invertebrates associated with the benthos. Corophium salmonis was the dominant food item, accounting for 33% of the total diet by weight. Though our sample size was small (N = 29), findings were consistent with recent studies of food habits of lower Columbia River white sturgeon.

Availability of suitable microhabitats for spawning and embryo incubation may affect year-class strength. We speculate that water velocities, a function of discharge and channel morphology, may cue spawning and/or influence survival of yolk sac larvae. Younger age groups of white sturgeon, though, appear to be generalists in their habitat requirements.

STURGEON EARLY LIFE HISTORY AND GENETICS STUDY. E. Brannon/A. Setter - University of Idaho, Moscow, ID. (BPA Project Officer: Fred Holm)

The genetics and early life history studies of Columbia river white sturgeon were undertaken as background for future management options and enhancement of white sturgeon in the Columbia system, in response to increased harvest rate on that species. Sturgeon are confined within reservoirs or between dams over much of the river, and the productivity of some areas cannot sustain concerted fishing pressure. Sturgeon hatcheries or enhancement programs using lower river sturgeon stocks need to be concerned, however, about the regionality of sturgeon stocks, and the suitability of reservoir environments for sturgeon habitation.

The 1985-1989 genetics sampling regime broadly covered the distribution range of white sturgeon in the Columbia River, in areas associated with the upriver pool, two large tributaries and the estuary. Data indicates that a general similarity exists among fish inhabiting the lower and mid-Columbia, Snake River, Lake Roosevelt, and Kootenay River. However, based on both variability and number of rare alleles, some historic population segregation may be present.

Electrophoretic analysis using horizontal starch gel techniques has provided data that support genetic differentiation between the geographic areas examined. While the quantity of variation observed tended to increase with greater sample sizes due to the presence of rare alleles, we feel our baseline survey has given a solid framework elucidating what can be expected in terms of differentiation. Twenty-eight loci were defined and examined in all individuals if the appropriate tissues were available. White sturgeon from Ilwaco at the mouth of the Columbia River showed the creates diversity of variation; the Kootenay River showed the least.

Early life history studies have shown that sturgeon larvae and fry are susceptible to and respond to river velocities for distribution. They are continuously in motion after yolk absorption, they are dark oriented, and they locate feed by a combination of sensory systems, but not by vision. Fingerlings will dig in soft substrate for prey and can be decoyed by electrical impulses. Larger sturgeon readily feed on salmon and show less attraction to their own species, although they are not as reluctant to feed on sturgeon flesh without skin.

Distribution of sonic tagged adult size sturgeon in Roosevelt Lake indicated that the reservoir was inhabited and as much as the free flowing river. Preferred areas appeared to be close to the interface between reservoir and stream flow. However, this section of the river was in the Marcus area which was characterized by a large plain 40 to 90 feet deep, and appeared to be a preferred habitat. Movement from the Marcus area occurred upstream several miles, and downstream into the main body of the reservoir, but the fish often returned to Marcus. Riverine habitat was selected by some of the sturgeon during the spring and summer months, and many of these would return to the Marcus area in the fall and winter. Behavior and stains on the underside of the fish suggested that many of the sturgeon remained predominatly in certain sections of the reservoir. Tagged fish were observed to move more than 20 miles in one day, but others as little as a few miles over several months, based on periodic monitoring.

KOOTENAI RIVER WHITE STURGEON INVESTIGATIONS AND EXPERIMENTAL CULTURE.

Kimberly A. Apperson and John T. Siple - Idaho Department of Fish and Game, Coeur D'Alene, ID. (BPA Project Officer: Fred Holm)

Many human activities have impacted the Kootenai River. Over the past 70 years, the lower river has been extznsively diked for flood control, effectively eliminating backwater and slough areas that may have provided fish rearing habitat. Contaminants have entered the river system via mining operations and agricultural practices. Libby Dam began operation in 1972, reversing the natural flow regime of the river, and releasing frequent power peaking flows.

The population of white sturgeon in the Kootenai River has continued to decline since 1982, in spite of a closure to harvest in the U.S. section of the river. Setline and angling techniques were used to sample over 300 sturgeon from the river between Kootenai Falls and Kootenay Lake during 1989 and 1990. Sturgeon were found primarily downstream from Bonners Ferry, Idaho. Our data indicate there is a complete lack of recruitment of juveniles into the population. The youngest fish sampled was of the 1977 year class, and the population was estimated at 880 individuals with 95% confidence intervals of 638 to 1,211.

The sex ratio among adult sturgeon in the Kootenai was l:l, with 34% of the females holding developing oocytes. All oocyte samples from nine females contained copper (1.15 to 2.50 u/g) and zinc (15.6 to 32.8 u/g). Most samples also contained organochloride residues such as DDT, DDD, DDE, and PCBs (0.215 to 1.080 u/g, combined).

Electrophoretic analysis of muscle samples indicated reduced heterogeneity compared with lower basin white sturgeon and showed a significantly different degree of variation between the two stocks in seven enzyme systems.

Use of sonic telemetry has revealed definite long distance movements in response to water flow fluctuations. Sturgeon regularly move across the British Columbia-Idaho border and seek out deep holes or migrate to Kootenay Lake during the late fall. Adequate ranges in river depth and current velocity allow sturgeon to select for those habitat parameters.

In April through June 1990, we observed a concentration of mature sturgeon, including transmitted fish, in an area of river with slightly elevated velocities (0.3 to 0.6 m/s).

Three mature females and 5 males were held in a large netpen throughout the spring of 1990. On July 19 one female and one male were successfully spawned, with 50,000 eggs taken to the College of Southern Idaho for incubation and rearing. We observed only 10% survival to cleavage among eggs that were shipped fertilized and deadhesed, compared with 35% initial survival of eggs fertilized immediately prior to incubation. Less than 10% of remaining embryos survived hatching and yolk absorption.

We recommend further investigation to iden ify levels of contaminants critical to sturgeon gamete viability and embryo and juvenile survival. We also recommend the use of experimental spring discharge to identify critical spawning velocity requirements. Due to total recruitment failure and genetic differences from other white sturgeon, we recommend developing a petition to list the Kootenai River white sturgeon as an endangered species.

KOKANEE STOCK STATUS AND CONTRIBUTION OF CABINET GORGE HATCHERY. Vaughn L. Paragamian - Idaho Department of Fish and Game, Coeur D'Alene, ID. (BPA Project Officer: Fred Holm)

The kokanee Oncorhynchus nerka rehabilitation program for Lake Pend Oreille continued to show progress during 1989. Estimated kokanee abundance in late August was 7.71 million fish. Even though abundance was 24% lower than 1988, it was 80% higher than the population's low point in 1986 and the second highest since the completion of Cabinet Gorge Hatchery in 1985. Decreased population size is the result of lower hatchery and wild fry recruitment and low age 1+ survival. Lower recruitment of wild fry in 1989 resulted from a smaller parental escapement in 1988 and lower wild fry survival.

Hatchery fry made up 50% of total fry recruitment (80% of total fry biomass), which is the second largest contribution since hatchery supplementation began in the 1970s. High hatchery fry abundance resulted from a large release (11.7 million fry) from Cabinet Gorge Hatchery in 1989 and good fry survival (19%) during their first summer in Lake Pend Oreille. Improved fry release strategies enhanced survival, which was seven times higher than survival in 1986 and approximately 35% higher than 1987 but 40% lower than 1988. Replication of releases in 1989 indicated that fry survival from release to fall sampling may range between 20% and 30%. Our research goal is to maintain 30% survival.

Six fry release strategies were evaluated in 1989 to enhance fry survival and adult returns to egg-take stations. Two groups were released in Clark Fork River to help establish a spawning run to Cabinet Gorge Hatchery. High river flows of 1000 m^3/s (36,000 ft^3/s) during the early release (June) helped flush fry quickly to Lake Pend Oreille and doubled survival (18%) over previous releases during lower flows of 570 m^3/s (20,000 ft^3/s) or less. Survival from the midsummer release (16%), which was barged down Clark Fork River to avoid low flow problems, was not significantly lower ($P>0.10$) than survival from the early release. The true success of these release strategies will be evaluated when adults return to Cabinet Gorge Hatchery in 1992 and 1993. Fry released to support the Sullivan Springs Creek spawning run also survived well (21%) in 1989. Two open water releases were made early and midsummer. The early release had the lowest survival (5%) of all strategies and was significantly lower ($P<0.10$) than any other release. A lack of cladoceran zooplankton and size of fry released may have ccntrituted to lower survival. The midsummer release also survived well (25%). Abundant forage and iow predation may have contributed to lower survival. The midsummer release also survived well (25%). Abundant forage and low predation may have contributed to higher survival. Fry released along shoreline in southern Lake Pend Oreille had the highest survival (27%). Abundant forage was probably also responsible for higher survival.

The fishery and egg-take may rebound siightly in 199C as a relatively strong year class matures. Effects of the rehabilitation program may be evident by 199i when the first strong year classes produced from Cabinet Gorge Hatchery enter the sport fishery and spawning escapement.

DWORSHAK DAM IMPACTS ASSESSMENT AND FISHERY INVESTIGATION. Greg Mauser - Idaho Department of Fish and Game, Orofino, ID. (BPA Project Officer: Bob Austin)

Dworshak Reservoir supports a productive fishery considering the infertile nature of the watershed and the influence of drawdown on water quality. Kokanee provide most of the fishing recreation. Yields reach 4.5 kg/ha despite low to moderate kokanee abundance.

Productivity has declined since impoundment in 1973. The reservoir is phosphorous limited. Plankton production has declined by as much as 50%. Bank erosion contributes suspended sediment that interferes with zooplankton grazing.

The zooplankton community is quite simple and supports relatively high percentages of cladocerans preferred by kokanee. Low planktivore densities compared to other kokanee fisheries may account for this. As a result kokanee growth is good and harvests high.

Routine entrainment losses keep the kokanee population below carrying capacity, preventing stunting and lower yields. However, periodic spill losses cause population depressions that lower fishing success to marginal levels despite producing larger, more vulnerable kokanee.

We propose long-term monitoring to define kokanee population response to reservoir operation. This will provide a sound basis for future management of the fishery. Introduction of a kokanee predator is not recommended now. We will review potential operating changes at project completion.

DWORSHAK RESERVOIR INVESTIGATIONS - TROUT, BASS AND FORAGE SPECIES. David P. Statler - Nez Perce Tribe, Orofino, ID. (BPA Project Officer: Bob Austin)

Data on Dworshak Reservoir (Idaho) fish populations were obtained from gill netting, electro-fishing and the creel. Comparisons with earlier data indicate a decline in overall productivity and the virtual disappearance of redside shiners (*Richardsonius balteatus*).

Smallmouth bass (*Micropterus dolomieui*) comprised 32 percent of the gill net catch and are widely established in the reservoir. Growth is slow to moderate. Bass attain the minimum legal size limit of 305 mm at age V. Survival (S) is quite high at .613 (.387 annual mortality (M)). The observed proportional stock density (PSD) of 23.1 is typical for smallmouth bass populations exhibiting slow growth and low mortality. Relative weights (Wr) were lower for the 101-200 mm and 201-300 mm size groups, as compared to fish <100 mm or >300 mm. The observed variation in Wr may suggest greater competition for food among bass LOO-300 mm. Fish and mayflies were most predominant in smallmouth bass stomachs analyzed.

Comparisons of Shasta and Arlee strain hatchery rainbow trout (*Oncorhynchus mykiss*) planted in 1988 and 1989 showed not substantial differences in growth or condition. Both strains successfully over-wintered and produced similar catch rates. Hybridization of rainbow trout and cutthroat trout (*Oncorhynchus clarki*) occurs in the Dworshak system, and priority for protecting and maintaining the endemic cutthroat trout may require modification or deletion of the rainbow trout stocking program in Dworshak Reservoir.

IAKE ROOSEVELT FISHERIES RESTORATION PROJECTS. Allan Scholz - Upper Columbia United Tribes Fisheries Center, Cheney, WA. (BPA Project Officer: Fred Holm)

In their 1987, Columbia River Basin Fish and Wildlife Program, the Northwest Power Planning Council directed Bonneville Power Administration (BPA) to fund: (1) Design, construction, and operation and maintenance (O&M) of two kokanee salmon hatcheries to supply 8 million kokanee fry for Lake Roosevelt [(Section 900 (G)(l)(C), Action Plan 1400 (7.3)]; (2) Improvements in passage, as well as spawning and rearing habitat, for wild, adfluvial rainbow trout in Lake Roosevelt tribtaries [Section 900(G)(l)(D). Action Plan 1400 (7.3)]; and (3) A monitoring program to evaluate effectiveness of the above measures [(Section 900(G)(l)(E), Action Plan 1400 (7.3 and 7.4)].

Design and environmental assessments were completed for both hatcheries in 1990. Construction of the Spokane Tribal kokanee hatchery and a Washington Department of Wildlife (WDW) kokanee hatchery has commenced. It is anticipated that construction of the Spokane tribal hatchery will be completed in January 1991 and WDW hatchery in August 1991. A lease agreement and O&M agreement were negotiated between BPA and the Spokane Tribe in May 1989. An O&M contract is currently in BPA's procurement office.

Habitat and passage improvements for wild, adfluvial rainbow trout in Lake Roosevelt Tributary Streams began in July 1990. The Colville Tribe is leading this effort, with assistance from the Spokane Tribe and WDW. Existing habitat and fish populations will be evaluated through July 1991. At that time cost-vs-benefit analysis will be performed and streams will be prioritized for implementing habitat or passage improvement projects. At the present time, existing habitat appears to be fully utilized except for streams that have blocks near their confluence with Lake Roosevelt. One common problem with Lake Roosevelt tributaries is that the riffle to pool ratio is about 3:l instead of an optimal ratio of 1:l.

The monitoring program to evaluate effectiveness of these fisheries enhancement measures began in August 19888, so that baseline data could be collected before hatcheries and habitat projects commence. The monitoring program will provide an accurate accounting to ratepayers of the value of these projects and provide important information for the management of the Lake Roosevelt fishery.

Tagging/recapture investigations were conducted to evaluate a rainbow trout net-pen program on Lake Roosevelt because the Spokane Tribal Hatchery will raise 500,000 rainbow fingerlings to support this program. Harvest rate of trout released at Seven Bays in May 1988 ws 9.9%, including all recoveries through May 1990. The majority (57.2%) of the tagged fish were recaptured within 20 km of the Seven Bays net pen site. Fewer than 1% (one fish) were recovered below Coulee Dam.

In contrast, fish released at both Seven Bays in April 1989 and Hunters in March 1989 evidenced much lower harvest rates compared to those released in May 1988. In 1989, the percentage of Seven Bays and Hunters trout harvested was respectively 3.0% and 1.9% through May 1990. For comparison, if just the first year after release data are used for fish released in May 1988, harvest was 8.7%. Fewer fish released in 1989 were recovered near the net-pen sites (38.2% at Seven Bays and 27.2% at Hunters). More fish were recovered below Grand Coulee Dam (26.4% from Seven Bays and 33.3% from Hunters). Six fish from Seven Bays (21.4% of total recoveries) and five fish from Hunters (17.6% of total recoveries) were collected at the fish counting facility at Rock Island Dam between May 10 and June 6, 1989. Three fish (8.8% of total recoveries) from Seven Bays and two fish (9.5% of total recoveries) from Hunters were recovered in Rufus Woods Reservoir. These data suggest that large numbers of net-pen fish were lost over Grand Coulee Dam in 1989 but not in 1988.

Reservoir operations were markedly different in 1988 and 1989. Drawdown was prolonged and more pronounced in 1989 than in 1988. Part of the reason that drawdown occurred earlier than normal was because of extreme cold weather in February that severely taxed the energy supply of the Columbia Basin. This caused Lake Roosevelt to be lowered by about 0.5 m/day for several weeks in February and March. At the start of this period the reservoir was already at a lower level than normal owing to drought conditions. Net-pen operators worried that declining water levels would ground their net pens, so they released their fish earlier than normal -- in March (at Hunters) and April (at Seven Bays) instead of in May. Therefore, net pen operators should retain their fish until May or June to allow trout to become residualized and site imprinted. This should increase the percentage harvested by anglers in Lake Roosevelt. Management agencies providing fish for Lake Roosevelt net-pens should develop contracts with net-pen operators that specifies a release date ranging from May 10 to June 10.

LAKE ROOSEVELT FISHERIES INVESTIGATIONS 1988-1989. Janelle Griffith, Allan Scholz, Tim Peone - Upper Columbia United Tribes Fisheries Center, Eastern Washington University, Cheney, WA. (BPA Project Officer: Fred Holm)

The purpose of the Lake Roosevelt monitoring project was to evaluate the effectiveness of two kokanee salmon hatcheries. Baseline data was collected during August through December in 1988, and January through December in 1989 before hatchery start-up.

From August to December 1988, the total harvest was estimated to 125,89 + 74,629 fish, including 9,362 + 3,873 kokanee, 86,107 + 31,940 rainbow trout, and 23,005 + 8,731 walleye. From January to December-1989, the total harvest was estimated to be 164,227 + 63,035 fish, including 11,906 + 3,597 kokanee, 65,515 + 25,373 rainbow trout, and 80,626 + 33,513 walleye. -Angling pressure was estimated at 261,913 angler hours (70,308 angler trips) from August to December in 1988, and 756,397 angler hours (139,873 angler trips) from January to December 1989. Estimated economic value of the fishery was $2,031,901 for August to December in 1988, and $4,042,329 for January to December in 1989.

A total of 10,895 fish were collected during gillnet and electrofishing surveys conducted in August and October 1988, and May, August and October 1989. Relative abundance included yellow perch (36.2%), walleye (18.5%), rainbow trout (6.6%), kokanee (2.8%), centrarchidae (3.9%), rough fish (26.4%), Cottidae (1.7%), Ascipenseridae (<1%), and Gadidae ((1%).

Kokanee comprised only 2.8% (310 fish) in relative abundance surveys. Total kokanee harvest was estimated to be 9,362 + 3,873 in 1988, and 11,906 + 3,597 in 1989 creel surveys. This data indicated a low abundance of kokanee in Lake Roosevelt prior to hatchery construction and operation.

The average size of kokanee harvested by anglers was 432 mm and 739 g in 1988, and 411 mm and 580 g in 1989. The mean size of age 3+ kokanee, the principle spawning year class, collected in electrofishing and gillnet surveys was 463 mm and 1,052 g in 1988, and 413 mm and 813 g in 1989. The average size of rainbow harvested by anglers was 391 mm and 646 g in 1988, and 403 mm and 710 g in 1989. The mean size of age 3+ rainbow trout collected in electrofishing and gillnet surveys was 473 mm and 1096 g in 1988 and 429 mm and 902 g in 1989. Growth rates of kokanee and rainbow trout, based on back-calculation from scales, were greater than the average growth of kokanee and rainbow from other lakes and river systems used for comparison. Walleye growth was approximately average in the comparisons.

Mean zooplankton densities collected at nine index stations in August and October 1988, were 6,589 cladocerans, and 8,929 adult copepods/m^3. Mean zooplankton densities collected at nine index stations in May, August, and October 1989, were 4,378 cladocerans, and 6,540 adult copepods/m^3. Daphnia spp. accounted for 92.6% of the cladocera density in 1988 and 90.4% in 1989.

Feeding habits of kokanee, rainbow trout and walleye were different as evidenced by numerical percentages, weight percentages, frequency of occurrence, index of relative importance and diet overlap calculations. Kokanee were principally planktivorous, rainbow omnivorous and walleye piscivorous. These data imply that it may be feasible to successfully manage all three species in Lake Roosevelt. Kokanee and rainbow trout fisheries could be enhanced due to the abundance of large zooplankton. Walleye fishery enhancement is not recommended due to lack of forage fish.

Floy tagging studies of net-pen rainbow trout indicated that fish released in early spring have lower harvest rates than fish released in May or June. Therefore, it is recommended that net pen operators retain their fish until May or June to increase catch rates and reduce the numbers of fish lost through the dam.

Walleye tagging studies indicated that the fish migrate extensively throughout the reservoir as evidenced by angler tag returns reporting catch location. For example, in 1989, five of 602 fish tagged in the Spokane Arm traveled approximately 220 km to Canada within 29 to 71 days of their initial capture.

The average fecundity of age 3+ kokanee collected in 1988 and 1989 was 1,615 eggs/female, highest reported for any Inland Northwest lake. This finding was encouraging because it indicates that using native fish to supply eggs needed for hatchery operations is feasible.

ASSESSMENT OF EXISTING FISH POPULATIONS AND FISHERY IMPROVEMENT OPPORTUNITIES IN BOX CANYON RESERVOIR, PEND OREILLE RIVER, WA. Becky Renberg-Ashe and Allan Scholz, Upper Columbia United Tribes Fisheries Center, Cheney, WA. (BPA Project Officer: Fred Holm)

This three year study was initiated as part of the Northwest Power Planning Council's 1987 Columbia River Basin Fish and Wildlife Program to obtain baseline information on existing fish populations and assess the fishery improvement opportunities on the Box Canyon portion of the Pend Oreille River, WA.

Electrofishing surveys resulted in the capture of 19,931 fish from March through October 1988, and 17,554 fish from Sovember 1988 through December 1989. In 1988, the catch was composed of 42% yellow perch, 19% pumpkinseed, 10% tench, 7% largemouth bass, and 4% mountain whitefish. In 1989, the catch was composed of 45% yellow perch, 17% pumpkinseed, 9% largemouth bass, 8% tench, and 6% mountain whitefish. Brown trout were the most abundant of the salmonids during both years, at 0.7%.

Population estimates for target species in the reservoir determined that the yellow perch population was 41,777,446 in 1988 and 6,101,448 in 1989, the pumpkinseed population was 16,822,372 in 1988 and 3,889,758 in 1989, the largemouth bass population was 657,549 in 1988 and 590,906 in 1989, and the mountain whitefish was 164,252 in 1988 and 163,890 in 1989. In 1989, the brown trout population was estimated at 7,264.

In 1989, trout populations were estimated in five tributaries to the reservoir. The mean densities of brown trout, brook trout and cutthroat trout from Skookum Creek were 22, 18, and <1 fish/LOO m^2, respectively. The mean densities from Cee Cee Ah Creek were 16 fish/LOO m^2, for brown trout, 12 fish/100 m^2 for brook trout and 3 fish/LOO m^2 for cutthroat trout. The mean densities of brook trout and cutthroat trout from Tacoma Creek were 20 and 4 fish/100m^2, respectively. The mean densities of brown trout, brook trout, rainbow trout and cutthroat trout from LeClerc Creek were 2, 7, <1 and <l fish/LOO m^2, respectively. Ruby Creek brook trout densities were 38 fish/100 m^2 and cutthroat trout densities were <l fish/100 m^2. Remnant populations of bull trout were also observed at the mouth of LeClerc Creek, Cee Cee Ah Creek, and Char Springs.

Growth rates for largemouth bass in the Box Canyon Reservoir were lower than bass from other locations in the northwestern United States during their first four years. However, growth rates after the fourth year were comparable to other locations, and in some cases higher. Although their growth rates were lower than normal, a substantial number of largemouth bass in excess of 500 mm were captured.

In the reservoir, growth rates and condition factors for yellow perch, black crappie, brown trout, cutthroat trout, and rainbow trout were low in comparison to other locations. Although the growth rates tend to be low, trout do attain a respectable size, as several brown trout over 600 mm, a 905 mm rainbow trout, and three bull trout ranging from 600-800 mm were captured in the reservoir. Growth rates for mountain whitefish were good compared to those from other locations. In the tributaries, growth rates of brown trout were low but cutthroat and brook trout growth was high in relation to other locations in the Pacific Northwest.

Mean annual invertebrate densities in the river ranged from 4,508 to 17,234 organisms/m^2 in 1988, and 5,715 to 24,004 organisms/m^2 in 1989. Macroinvertebrate densities in slough sites ranged from 6,415 to 13,354 organisms/m^2 in 1988, and 8,387 to 38,629 organisms/m^2 in 1989. Mean annual invertebrate densities in Pend Oreille River tributaries ranged from 4,823 organisms/m^2 in LeClerc Creek to 5,921 organisms/m^2 in Cee Cee Ah Creek in 1988 and 1,738 organisms/m^2 in Ruby Creek to 4,658 organisms/m^2 in Skookum Creek. These densities all tended to be low in comparison to other systems in the northwest.

The mean annual zooplankton density for the reservoir during 1988 was 122 organisms per liter and was composed of 32% copepods and 10% cladocerans. Cladocerans biomass for 1988 was 22 μg/l. Mean annual zooplankton density during 1989 was 112 organisms/l and was composed of 17% copepods and 5% cladocerans. Biomass for cladocerans in 1989 was 11 μg/l. Cladoceran and copepod densities from the mid-channel of the reservoir were from average to high in comparison to other lakes and reservoirs in the region. Samples collected from the littoral zone in 1989 had a mean density of 120 organisms/l, and were composed of 23% copecods ana 17% cladocerans.

Diet analysis of river and slough fish revealed that black crappie, tenth, and 0+ through 3+ Largemouth bass were primarily planktivorous and yellow perch, whitefish, and brown trout fed most frequently on benthic macroinvertebrates. Older largemouth bass and northern squawfish were piscivorous. Diet overlaps were high between yellow perch and young bass due to their common reliance upon zooplankton as a food item. High overlaps were common between other fish species in the reservoir, in general, as a result of many species of fish utilizing Chironomidae larvae, Daphnidae and Chydoridae.

The recapture of tagged fish showed that most remain in the same area where they were tagged. Fish that did move tended to move only short distances. Many of the largemouth bass that moved had been caught and displaced by bass tournament anglers.

Angler effort was estimated at 4,139 ± 478 angler hours in 1988 (March - December) and 3,029 + 374 angler hours in 1989 (January - December). CPUE was estimated at 2.4 fish/hour in1988 and 5.9 fish/hour in 1989. Total catch (+95% C.I.) for 1988 was 10,082 + 1181. Of these, 44% were yellow perch, 34% were largemouth bass, and 10% were rough fish. In 1989 the total catch (+ 95% C.I.) was 3,029 + 374. Fifty two percent of these were largemouth bass, 35% were yellow perch, and 8% were black crappie and pumpkinseeds. Harvest (+95% C.I.) was estimated at 2,505 + 3,121, in 1988. Of this, yellow perch were 51% and largemouth bass were 16%. In 1989, harvest (95% C.I.) was estimated at 1,331 + 164 with 52% being yellow perch, 14% bull trout and 14% black crappie and pumpkinseeds. In both 1988 and 1989 most of the largemouth bass caught were released. Harvest of bass was 389 + 40 in 1988 and 103 + 12 in 1989.

Recommendations for fishery improvement include: (1) restoration of native cutthroat and bull trout in the tributaries to the Pend Oreille River, and (2) enhancement of the largemouth bass populations and habitat in the reservoir.

RESERVOIR MODELING LIBBY/HUNGRY HORSE. Brian Marotz - Montana Department of Fish, Wildlife, and Parks, Kalispell, MT. (BPA Project Officer: Dale Johnson)

Computer models were constructed to evaluate the biological effects of dam operation and produce dam operation guidelines for optimizing biological production. Physical and biological data from 1983 through 1989 were used to calibrate model equations. The models consist of four components: physical hydrology, thermodynamics and biological; primary production, secondary production and fish growth. Calculations in the higher trophic level model components receive input from the preceding trophic submodel(much as energy is transferred through a biological system. Submodels were calibrated to field measurements individually to avoid unrealistic predictions of dam operation effects on reservoir biology.

Model simulations and the results of the trophic level investigations were used to assess the effects of various dam operating scenarios on abiotic factors and reservoir biota. Reservoir drawdown reduces the volume of optimum water temperatures for phytoplankton and zooplankton production. Dewatered substrate limits the production of aquatic insects which begin as stationary larvae residing in the bottom muds. Reduced surface area traps a smaller amount of insects deposited on the water from the surrounding land. The result is less food production for gamefish and decreased growth rate. The main effects of dam construction and operation are reduced recruitment of juvenile fish to the reservoir and limited spring food supply.

Biological rule curves developed for dam operation are flexible, depending on inflow. Rule curves were also developed for the four years of a critical drought period. The critical period curves were assessed for impacts on firm power production. Some modification of the curves will be required to balance power generation and biological production.

Selective withdrawal of water from stratified temperature Layers in the reservoir could improve downstream riverine temperatures toward natural conditions. A model component designed to assess selective withdrawal using historic dam operation records, showed that the proposed retrofit structure could increase trout growth potential in the Flathead River between two and five times. Selective withdrawal negatively influences reservoir production by increasing downstream loss of phytoplankton, zooplankton, and warm water. Downstream loss could be reduced by fine tuning withdrawal depths to avoid the most productive layers, yet achieve tne best temperature effect. The net reduction in reservoir production is acceptable in light of the major benefits in 47 miles of the Flathead River.

Some improvements in reservoirproduction can be accomplished using strategies which have no effect on electric generation. Pilot programs have begun to assess the most cost effective way to improve the fishery by increasing juvenile fish recruitment and increasing spring food supply. However, operational changes will be needed to assure successful fisheries mitigation.

MONTANA WILDLIFE MITIGATION OVERVIEW. Harvey Nyberg - Montana Department of Fish, Wildlife, Parks, Kalispell, Montana. (BPA Project Officer: Robert Walker)

Two units of the Columbia River Hydroelectric System, Libby and Hungry Horse Dams, occur in Montana. Hungry Horse Dam was completed in 1953 and flooded 23,750 acres. Libby Dam was completed in 1973 and flooded 48 miles of the Kootenai River and 28,850 acres of productive habitats in the US. Prior to the NW Power Act, impacts at Hungry Horse were not mitigated. At Libby Dam, a mitigation plan developed under the Fish and Wildlife Coordination Act (1958) called for acquiring 12,000 acres of replacement habitat and Congress appropriated $2 million. Funding was exhausted acquiring 2,500 acres of mitigation lands. Acquisition of the remaining 9,500 acres was not done.

Mitigation planning followed the four step process prescribed in the Council's Columbia Basin Fish and Wildlife Program. Loss statements and summaries of previous mitigation were completed in 1984 and mitigation plans were completed in 1985 and submitted to NPPC for amendment into the Fish and Wildlife Program. Because of the perceived high cost, Council directed the interested parties to try to reach a negotiated settlement. Negotiations between the affected parties were held between April and October 1986. From those negotiations, a consensus plan emerged. That plan was submitted to Council with support from the utility community and selected portions of the plan were amended into the Program in February 1987.

Montana's wildlife mitigation program has two major types of projects: enhancement and habitat protection. The enhancement projects seek to replace wildlife losses by enhancing National Forest lands adjacent to the reservoirs. Existing winter ranges have been degraded by a combination of fire suppression and advanced plant succession. These projects will restore the habitat conditions that would occur naturally in the presence of wildfire. The target species for these projects are big game, but they will benefit al those species normally associated with the restored habitats.

The Habitat Protection Project is designed to replace habitats for species where adequate mitigation cannot be achieved on site. They include waterfowl, Columbian sharp-tailed grouse, black and grizzly bears and terrestrial furbearers. This project will use various habitat protection strategies including fee title acquisition, conservation easements, management agreements, leases and others to achieve the desired results.

Montana's wildlife mitigation program will be funded by earnings from a Trust Fund Account. In December 1988, the State of Montana, Montana Fish, Wildlife and Parks and Bonneville Power Administration signed the Wildlife Mitigation Agreement for Libby and Hungry Horse Dams. According to that agreement, Bonneville will pay $12.5 million in lump sum payments over a period of 6 years. That money will go into a special account earmarked for wildlife mitigation for Libby and Hungry Horse. In exchange for the lump sum payment, Montana agreed to indemnify BPA for all wildlife mitigation required to offset impacts due to the development of the reservoirs for a term of 60 years. Other terms of the agreement specify that Montana establish an Advisory Committee to provide "advice and guidance" in the design and implementation of wildlife mitigation activities pursuant to the agreement.

NORTHWEST MONTANA WILDILFE MITIGATION - HABITAT PROTECTION. Marilyn Wood - Montana Department of Fish, Wildlife and Parks, Kalispell, MT. (BPA Project Officer: Robert Walker)

The mitigation plans for Hungry Horse and Libby dams identified habitat protection as the most effective strategy to mitigate certain wildlife species where enhancement of publicly owned land for wildlife benefits is not appropriate or feasible. Important wildlife habitat found on private or state owned land are targeted for habitat protection measures to assure wildlife use now and in the future.

The Northwest Power Planning Council's Fish and Wildlife and Program identifies the mitigation goals for species requiring habitat protection. Program objectives include protecting 8,590 acres of critical grizzly bear/black bear habitat, 4,560 acres of prime waterfowl habitat, 2,462 acres of prairie habitat for Columbia sharp-tailed grouse, and 11,050 acres of old growth habitat for terrestrial furbearers. In 1987, a project was initiated to develop a habitat protection program to address these mitigation goals. Project objectives were to: (1) develop an implementation process for habitat projection using conservation easements, fee acquisition, or lease agreements; (2) identify program objectives and critical sites requiring protection for grizzly and black bears, waterfowl and wetlands, and Columbian sharp-tailed grouse; (3) initiate a pilot project, and; (4) determine the feasibility of obtaining cooperative agreements with Department of State Lands and other landowners to protect terrestrial furbearer habitat.

An implementation process was developed to identify cost-effective mitigation projects that achieve biological objectives and promote cooperation and coordination with other agencies and private organizations. Three technical committees were established to identify goals and objectives for each program and develop criteria for projects. A broad-based advisory committee was established to provide MDFWP with diverse perspectives on program direction and review merits of individual projects.

Grizzly bear/black bear habitat protection efforts will focus on important low elevation riparian habitat and adjacent uplands. Conservation easements or fee acquisitions will provide open space (secure habitat) and minimize potential for human/bear interactions. Objectives of the waterfowl/wetland program include protecting existing productive areas that are threatened with loss or destruction and enhancing marginal sites to increase waterfowl production. Projects will be consistent with the North American Waterfowl Plan, and other wetland mitigation projects.

Mitigation for Columbian sharp-tailed grouse required a different approach. The population of sharptails on the Tobacco Plains near Libby dam has declined drastically since the early 1970's. By 1987 only six grouse were observed on the dancing ground. A six month research project was completed to determine the feasibility of maintaining a sharp-tailed grouse population. Recommendations included protecting the known occupied habitat and the need tc identify other critical habitat requirements. A two year graduate student project was started in the spring of 1990 to identify critical nesting and brood rearing habitat.

Developing habitat protection strategies for terrestrial furbearers such as bobcat, lynx, and pine marten involved determining the feasibility of managing habitat in an area of checkerboard ownership with the Department of State Lands, U.S. Forest Service, and Plum Creek Timber Company, Inc. The opportunity to provide secure habitat for terrestrial furbearers by leasing State Lands is being pursued. Mitigation funds would be used to compensate the School Trust for any changes in current timer harvest strategies.

Three habitat protection projects were completed during this advanced design to help refine the process. A cooperative project with the Flathead National Forest resulted in protection of 1,094 acres of critical grizzly bear habitat adjacent to Glacier National Park. Mitigation funds were used to acquire a no-development easement on approximately 500 acres. A major waterfowl project was developed which included purchase of 800 acres of sub-irrigated meadows and impoundment development by Ducks Unlimited. A pre-engineering report was completed which indicated the soils and hydrology were not adequate to support the project. A no-development conservation easement was obtained on 107 acres of low elevation riparian habitat to protect important bear habitat. Mitigation funds were used to provide the baseline documentation report.

NORTHWEST MONTANA WILDLIFE HABITAT ENHANCEMENT: HUNGRY HORSE ELK MITIGATION PROJECT. Daniel Casey - Montana Department of Fish, Wildlife and Parks, Kalispell, MT. (BPA Project Officer: Robert Walker)

During September 1987, Bonneville Power Administration (BPA) funded an elk/mule deer winter range enhancement project adjacent to Hungry Horse Reservoir. The goal of this project was to mitigate the loss of 8,750 acres of big game winter range flooded when the dam was built. Initial program goals are to enhance 6,650 acres of winter range to support an increased carrying capacity of approximately 133 elk. The initial phase of this enhancement project was designated as an advance design phase, to include implementation of population and vegetation monitoring, habitat mapping, and detailed literature review. The contract also called for the preparation of a long-term habitat enhancement plan, followed by detailed Monitoring and Evaluation Plan based on analysis of baseline data.

Two elk/mule deer winter ranges adjacent to (east of) the reservoir were selected as having potential for enhancement. Firefighter Mountain was selected as providing the most opportunity for enhancement, because of limited quantity and quality of winter forage. The Firefighter winter range is inhabitated by approximately 180 elk, most of which are resident animals. Two primary herd units were identified. Pellet-group and browse-utilization transect data indicated low levels of elk use at random sites on Firefighter Mountain. Proposed treatment sites in natural shrubfields received more use, but forage condition was poor throughout the winter range, and preferred browse species such as serviceberry, maple and redstem ceanothus comprised less than 15 percent of the available shrub forage.

A long-term enhancement plan was submitted to BPA during June 1990. That plan identified 71 habitat enhancement sites (67 at Firefighter, 4 in the Spotted Bear winter range). These included 13 sites in natural shrubfields, 6 sites where understory shrubs will be slashed, and 52 sites where some level of canopy removal will be used to create foraging areas. Enhancement activities will be funded through BPA, the U.S. Forest Service timber program, cooperative funding sources, and the Wildlife Mitigation Trust Agreement (between BPA and MDFWP). Enhancement work is scheduled to begin during spring 1991, and continue through at least 1996.

Preliminary Firefighter population data indicate a larger sample size of marked animals (45 elk, or 25% of the population), and more frequent aerial surveys will be needed during the proposed monitoring effort, to provide desired levels of accuracy in assessing population response to habitat treatments. Evaluation of enhancement efforts will also include pellet-group and browse utilization transects, and ECODATA methods developed by the Forest Service to collect standardized vegetation measurements. The monitoring effort is designed such that the principle of adaptive management can be used to guide subsequent elk habitat enhancement efforts adjacent to the reservoir.

URAL-TWEED BIGHORN SHEEP WILDLIFE MITIGATION PROJECT. Lewis Young - Kootenai National Forest, Rexford Ranger District; Chris Yde - Montana Department of Fish, Wildlife, and Parks; Gary Altman, Wildlife Biologist, Kootenai National Forest, Fisher River Ranger District. (BPA Project Officer: Robert Walker)

The results of habitat improvement project activities accomplished under contract #84-38 for bighorn sheep mitigation along Koocanusa Reservoir from September 1, 1984 through June 30, 1990, are reported here. Habitat treatments were conducted on bighorn sheep winter and spring ranges along the east side of Koocanusa Reservoir, and the primary goal of all treatments was to stimulate production of understory vegetation while maintaining an open overstory of mature ponderosa pine and Douglas-fir trees.

Three basic habitat treatments were used singly or in combination: slashing, prescribed fire, and fertilization. Slashing was used to (1) increase the fuel loading to manipulate fire intensity or behavior, (2) directly reduce the conifer canopy coverage, and (3) protect specific tree species from the fire effects. Prescribed fire was used to (1) rejuvenate decadent stands of shrubs, grasses, and forbs; (2) reduce the conifer overstory; and (3) reduce slash accumulations. Fertilization was applied with the objective of improving the forage quality and quantity.

Habitat enhancement work was initiated in the fall of 1984 and continued through 1990. A total of 1100 acres were treated. The 10 treatment units ranged in size from 25 to 280 acres. Costs varied among and within treatment types and ranged from $15 to $132/acre.

The nature of this project required intensive interagency coordination among the involved agencies to design, implement, and monitor the habitat treatments. The BPA habitat treatment units were designed to integrate with and complement the concurrent USFS helicopted timber sale that was designed to improve big game habitat.

A number of effects observed from the various treatments have implications for future treatments and are discussed.

DWORSHAK OLD GROWTH ADVANCE DESIGN. Jerome Hansen - Idaho Department of Fish and Game, Boise, Idaho. (BPA Project Officer: Robert Walker)

Advance design activities on the Dworshak old growth mitigation project began on September 15, 1990. Approximately 823 acres of old growth forest, including 67 acres of climax western red cedar forest, were lost due to the development of the Dworshak project. Optimum populations of many wildlife species are tied to old growth habitat, including the pileated woodpecker (Dryocopus pileatus). Implementation of this project will protect a stand of old growth forest in Section 11 (Township 43 North, Range 7 East) of the Buck Creek drainage, a tributary to the Little North Fork Clearwater River in northern Idaho. This stand of old growth is located on land that the Idaho Department of Fish and Game has recently obtained fee-title to, but not the timter rights. DAW Forest Products Company owns the timber rights. The stand of old growth will be harvested in the near future without implementation of this project. It is proposed that Bonneville Power Administration will reimburse DAW for the dollar value of the timber perserved on the area.

Advance design activities have included a pileated woodpecker Habitat Evaluation Procedure (HEP), general wildlife species inventory, small mammal trapping, section boundary delineations, negotiations with DAW Forest Products Company on acreage of old growth to be protected, and consultation and coordination with agencies, tribes, and local governments.

Preliminary results of the HEP indicate that the old growth provides near optimum piieated woodpecker habitat (HSI equals approximately 0.97). Two pileated woodpeckers were observed in Section 11 in September, along with numerous other nongame birds. Five small mammals were captured during trapping in October, including two boreal redback voles (Clethrionomys gapperi). The boreal redback vole is recognized as a species that reaches optimum populations under old growth habitat conditions. At this time, the Dworshak interagency work group proposes to protect approximately 105 acres of old growth habitat in the Buck Creek drainage. The final acreage proposal may vary based on the results of the timber cruise planned for this fall. Implementation of this project will also protect an extensive stand of Pacific yew (only known source of cancer-fighting drug, taxol) and water quality and stream stability in the Buck Creek drainage.

BONNEVILLE POWER ADMINISTRATION
FISH AND WILDLIFE PROGRAM
REVIEW, COORDINATION, AND CONSULTATION

Resident Fish and Wildlife Projects

November 6-7, 1990
Edgewater Lodge
Sandpoint, Idaho

Meetina Agenda

November 6, Tuesday

9:00 a.m.	Introduction
9:15 a.m.	Overview of White Sturgeon Research - Tony Nigro - ODFW.
9:30 a.m.	Life History and Population Dynamics of Subadult and Adult White Sturgeon between Bonneville and McNary Dams - Ray Beamesderfer - ODFW.
10:00 a.m.	Reproduction, Early Life History, Population Dynamics and Life History of Subadult and Adult White Sturgeon downstream from Bonneville Dam - John DeVore - WDF.
l0:30 a.m.	Break.
l0:45 a.m.	Reproduction and Early Life History of White Sturgeon downstream from Bonneville Dam - George McCabe - NMFS.
11:15 a.m.	Reproduction and Early Life History of White Sturgeon between Bonneville and McNary Dams - Lance Beckman - USFWS.
11:45 a.m.	Lunch.
1:00 p.m.	Early Life History and Genetics Study of White Sturgeon in the Columbia Basin, also Lake Roosevelt Investigations - Ernie Brannon/Ann Setter - U of Idaho.
2:00 p.m.	Kootenai River White Sturgeon Investigations and Experimental Culture - Kim Apperson/Jack Siple - IDFG.
2:45 p.m.	Break.
3:00 p.m.	Kokanee Stock Status and Contribution of the Cabinet Gorge Hatchery, Lake Pend Oreille - Vaughn Paragamian - IDFG.
3:30 p.m.	Dworshak Dam Impacts Assessment and Fishery Investigation - Greg Mauser - IDFG.

4:00 p.m.	Dworshak Dam Impacts Assessment/Rainbow and SM Bass - Dave Statler - Nez Perce Tribe.
4:30 p.m.	Adjourn.

November 7. Wednesday

8:00 a.m.	Overview of Lake Roosevelt Fishery Projects - Al Scholz - Eastern Washington University.
8:15 a.m.	Monitoring and Evaluation of Fishery Improvement Projects - Lake Roosevelt - Tim Peone/Janelle Griffith - Spokane Tribe.
8:45 a.m.	Assess Fishery Improvement Opportunities - Pend Oreille River - Becky Renberg - U.C.U.T.
9:15 a.m.	Development of Mitigation Plans for Kerr and Hungry Horse Dams/Relationship to BPA Funded Research Projects - Joe Dos Santos - Salish/Kootenai Tribe - John Fraley - MDFWP.
l0:15 a.m.	Break.
l0:30 a.m.	Libby Reservoir/Kootenai River Study - Don Skaar - MDFWP.
11:00 a.m.	Reservoir Modeling Libby/Hungry Horse - Brian Marotz - MDFWP.
11:45 a.m.	Lunch.
1:00 p.m.	Montana Wildlife Mitigation Overview - Harvey Nyberg - MDFWP.
1:30 p.m.	Acquisition and Habitat Protection - Marilyn Wood - MDFWP.
2:00 p.m.	Hungry Horse Elk Project - Dan Casey - MDFWP/ Henry Rivera - USFS.
2:30 p.m.	Break.
2:45 p.m.	Wildlife Enhancement - Mule Deer/Bighorn Sheep - Chris Yde - MDFVP/Lewis Young and Gary Altman - USFS.
3:45 p.m.	Idaho Timber Advance Design - Allyn Meuleman - IDFG.
4:00 p.m.	Discussion/Announcements, etc.
4:30 p-m-	Adjourn.

LIST OF ATTENDEES

November 6 and 7, 1990

NAME	AGENCY	PHONE
Rob Swedo	BPA	(509) 353-2913
Ernie Brannon	U of ID	(208) 885-5830
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